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10/671,980	09/26/2003	Byeong Soo Bae	ASIAP119	8857

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EXAMINER
MARKHAM, WESLEY D

ART UNIT	PAPER NUMBER
1762	

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Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/671,980

Applicant(s)

BAE ET AL.

Examiner

Wesley D Markham

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 05 January 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Response to Amendment***

1. Acknowledgement is made of the amendment filed by the applicant on 1/5/2005 (with a certificate of mailing dated 12/29/2004) in which the specification of the instant application, including the title, was amended, and Claim 2 was amended. **Claims 1 – 10** are currently pending in U.S. Application Serial No. 10/671,980, and an Office Action on the merits follows.

### ***Drawings***

2. The objection to the drawings set forth in paragraph 3 of the previous Office Action (i.e., the non-final Office Action dated 7/29/2004) is withdrawn in light of the applicant's amendment to add reference numbers "4" and "5" into the specification. As such, the formal drawings filed on 9/26/2003 are approved by the examiner.

### ***Specification***

3. The objections to the specification set forth in paragraphs 4 – 6 of the previous Office Action are withdrawn in light of the applicant's amendment to correct a typographical error and provide a descriptive title of the invention.

### ***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. The rejection of Claims 2 – 4 and 8 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention, set forth in paragraphs 9 and 10 of the previous Office Action, is withdrawn in light of (1) the applicant's amendment to replace the term "hydrocarbon atoms" with "hydrocarbon groups" in Claim 2, and (2) the applicant's remarks clarifying the scope of "benzophenone/amines" and "thioxane/amines" in the context of Claim 8 (see paragraph bridging pages 5 and 6 of the 1/5/2005 amendment).

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order

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for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1 – 3 and 5 – 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuramoto et al. (US 2003/0228120 A1) in view of Chandross et al. (USPN 3,809,732).
9. Regarding independent **Claim 1** (from which Claims 2 – 10 depend), Kuramoto et al. teaches a method for manufacturing a planar optical waveguide, the method comprising the steps of forming a lower cladding layer “14” on a substrate “13” (Figures 3 and 4; paragraphs [0031], [0034], and [0140] – [0142]); depositing an optical waveguide layer “15” on the lower cladding layer “14” (Figures 3 and 4; paragraphs [0016], [0019] – [0021], [0031], and [0142] – [0143]); patterning the optical waveguide layer “15” to form a core portion “15a” that is thicker than the surrounding material of layer “15” (Figures 3 and 4; paragraphs [0142] – [0143]); and depositing an upper cladding layer “16” on the patterned waveguide (Figure 4; paragraphs [0034] and [0145]); wherein the optical waveguide layer comprises an inorganic-organic hybrid matrix and is polymerized (i.e., “cured”) by thermal heating (paragraphs [0002], [0011], [0019] – [0021], [0031], [0058], and Claim 15). Kuramoto et al. does not explicitly teach that the inorganic-organic hybrid matrix core is uniformly doped with photosensitive photochemical monomers, is selectively exposed to a beam having a predetermined wavelength region, and unexposed monomers are removed. However, the inorganic-organic hybrid matrix waveguide

layer of Kuramoto et al. comprises a polymeric component such as polymethylmethacrylate (PMMA) (paragraphs [0019] and [0021]) and is patterned (e.g., via a mold pressing operation) to have thicker waveguiding core portions "15a" surrounded by thinner portions "15" (Figures 3 and 4; paragraphs [0142] – [0143]). Chandross et al. teaches a method of manufacturing an optical waveguide device by using a "photolocking" technique (Col.2, lines 35 – 40). In this technique, a waveguide material based on a polymer such as PMMA (i.e., a polymer as taught by Kuramoto et al. to be a component of the waveguide layer) is uniformly doped with photosensitive photochemical monomers, deposited on a substrate, dried by evaporating the solvent, selectively exposed to a beam having a predetermined wavelength in order to photolock the monomers into the waveguide material layer, and heated to remove the unexposed monomers (Figures 1 and 2A – 2D; Col.1, lines 14 – 29, Col.2, lines 30 – 71, and Cols.3 – 6). This "photolocking" process produces a waveguide having a thicker guiding (i.e., core) region surrounded by thinner regions of material (Figure 2D; Col.1, lines 26 – 28, Col.2, lines 42 – 63, and Col.5, lines 41 – 53), which is exactly the goal of the waveguide patterning process of Kuramoto et al. The photolocking process taught by Kuramoto et al. has the following advantages: (1) smooth refractive index and thickness profiles, (2) minimized scattering losses, (3) high spatial resolution, and (4) relative simplicity and economy (Col.2, lines 63 – 71). Therefore, it would have been obvious to one of ordinary skill in the art to form the patterned inorganic-organic hybrid matrix waveguide layer of Kuramoto et al. by photolocking (i.e., uniformly doping the layer

with photosensitive photochemical monomers, selectively exposing the layer to a beam having a predetermined wavelength region, and removing unexposed monomers by heating), as taught by Chandross et al., with the reasonable expectation of (1) success, as the waveguide layers of both Kuramoto et al. and Chandross et al. comprise a polymeric material such as PMMA, and (2) obtaining the benefits of using photolocking to form the waveguide layer, such as producing a waveguide layer having thicker core portions surrounded by thinner portions of material, the waveguide having a smooth refractive index and thickness profile, minimal scattering losses, a high spatial resolution, and a relatively simple and economic method of production. Regarding **Claim 2**, the combination of Kuramoto et al. and Chandross et al. also teaches that the hybrid matrix contains silicon and oxygen atoms (paragraphs [0019] – [0020] of Kuramoto et al.) but does not explicitly teach that at least a fraction of the silicon is directly bonded to substituted or unsubstituted hydrocarbon groups / moieties. However, the entire inorganic-organic hybrid matrix of Kuramoto et al. is based on polymerizing and bonding (1) organically (e.g., hydrocarbon) modified alkoxides based on metals such as silicon with (2) organic polymers (i.e., materials also based on or comprising hydrocarbon groups) (paragraphs [0019] – [0021]). Therefore, it is the examiner's position that at least a fraction of the silicon atoms (i.e., from the silicon alkoxide) in the hybrid matrix of Kuramoto et al. would have inherently been directly bonded to substituted or unsubstituted hydrocarbon groups / moieties. Regarding **Claim 3**, the combination of Kuramoto et al. and Chandross et al. also teaches that the hybrid matrix

comprises an oxide of a metal selected from the elements of groups 3A, 4A, and 3B-5B of the periodic table, and combinations thereof (paragraphs [0019], [0020], and [0058], and Claim 14 of Kuramoto et al.). Regarding **Claims 5 – 7**, the combination of Kuramoto et al. and Chandross et al. also teaches that the photochemical monomers are capable of being dimerized upon radiation, chemically bonding to chains constituting the matrix upon radiation, and/or being polymerized in the matrix upon radiation (Col.3, lines 39 – 55, Col.4, lines 42 – 65 of Chandross et al.).

Regarding **Claim 8**, the combination of Kuramoto et al. and Chandross et al. also teaches that the monomers are selected from the group of monomers claimed by the applicant (Col.6, lines 36 – 37, Col.8, lines 52 and 61 of Chandross et al.).

Regarding **Claims 9 and 10**, the combination of Kuramoto et al. and Chandross et al. teaches that the waveguide is formed by exposure to a beam through a mask covering the waveguide layer (Col.5, lines 28 – 35 of Chandross et al.) or exposure to a laser without a mask (Figure 2C; Col.5, lines 6 – 17, and Col.6, lines 52 – 58 of Chandross et al.).

10. Claims 2 – 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuramoto et al. (US 2003/0228120 A1) in view of Chandross et al. (USPN 3,809,732), in further view of Dawes et al. (USPN 6,144,795).

11. The combination of Kuramoto et al. and Chandross et al. teaches all the limitations of **Claim 4** as set forth above in paragraph 9, except for a method wherein the hybrid matrix comprises fluorine atoms. However, it is clear that the hybrid matrix of



Kuramoto et al. is open to including various dopant species (paragraph [0058], for example). Dawes et al. teaches that, in the art of producing an inorganic-organic hybrid optical waveguide device (i.e., with a waveguide material analogous to that of Kuramoto et al.'s), it is desirable to include fluorine atoms in the matrix in order to suppress an undesirable infrared absorption band (Col.1, line 32, Col.5, lines 27 – 28, and Col.8, lines 7 – 16). Therefore, it would have been obvious to one of ordinary skill in the art to include fluorine atoms in the inorganic-organic hybrid matrix material of the combination of Kuramoto et al. and Chandross et al. with the reasonable expectation of successfully and advantageously suppressing an undesirable infrared absorption band in the waveguide material, thereby reducing optical losses in the waveguide.

12. As an alternative to the reasoning presented above in paragraph 9, the combination of Kuramoto et al. and Chandross et al. teaches all the limitations of **Claims 2 – 4** except for a method wherein the hybrid matrix contains (1) silicon and oxygen atoms, with at least a fraction of the silicon being directly bonded to substituted or unsubstituted hydrocarbon atoms, (2) an oxide of a metal selected from the elements of groups 3A, 4A, and 3B-5B of the periodic table, and combinations thereof, and (3) fluorine atoms. Dawes et al. teaches an inorganic-organic hybrid material used to form the core of a planar optical waveguide, the material comprising (1) silicon and oxygen atoms, with at least a fraction of the silicon being directly bonded to substituted or unsubstituted hydrocarbon atoms, (2) an oxide of a metal selected from the elements of groups 3A, 4A, and 3B-5B of the periodic table, and

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combinations thereof, and (3) fluorine atoms (Abstract, Col.1, lines 17 – 41, Col.2, lines 40 – 67, Col.4, lines 40 – 67, Cols. 5 – 6, Col.7, lines 52 – 67, Col.8, lines 1 – 16, and Col.10, lines 51 – 57). This hybrid material taught by Dawes et al. has the following advantages: (1) low cost, (2) low absorbance, (3) can have a range of indices of refraction, (4) rapid deposition, and (5) unique visco-elastic properties that enable the material to avoid stress build-up during polymerization / curing (Col.2, lines 29 – 33, Col.11, lines 38 – 43). Therefore, it would have been obvious to one of ordinary skill in the art to utilize the inorganic-organic hybrid material of Dawes et al. as the waveguide material in the process of the combination of Kuramoto et al. and Chandross et al. with the reasonable expectation of successfully and advantageously utilizing a material for the waveguide core that is low cost, has low absorbance, can be rapidly deposited, and has unique visco-elastic properties that enable the material to avoid stress build-up during polymerization and curing.

13. Claims 1 – 3 and 5 – 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chandross et al. (USPN 3,809,732) in view of Zha (US 2003/0195321 A1).
14. Regarding independent **Claim 1** (from which Claims 2 – 10 depend), Chandross et al. teaches a method of manufacturing a planar optical waveguide, the method comprising the steps of depositing an optical waveguide layer “21” or “22” on a substrate “24”, and patterning the optical waveguide layer by using a photolocking technique, wherein the optical waveguide layer comprises an organic (i.e., polymeric) matrix uniformly doped with photosensitive photochemical monomers, is

selectively exposed to a beam having a predetermined wavelength region, unexposed monomers are removed, and the patterned layer is cured by thermal heating (Figures 1 and 2A – 2D; Col.1, lines 14 – 29, Col.2, lines 30 – 71, and Cols.3 – 6). Chandross et al. does not explicitly teach that (1) a lower cladding layer is deposited on the substrate below the optical waveguide layer, and an upper cladding layer is deposited on the patterned waveguide layer, and (2) the matrix is an inorganic-organic hybrid matrix. Zha teaches that, in the art of manufacturing planar optical waveguides (paragraph [0043]), a waveguide is typically and preferably produced by forming a lower cladding layer on a substrate, a core layer on the lower cladding layer, and an upper cladding layer on the core layer, wherein the cladding layers have a lower refractive index than the core layer and the same refractive index as each other in order to insure that the guided optical mode is symmetric (paragraph [0072]). Therefore, it would have been obvious to one of ordinary skill in the art to deposit a lower cladding layer on the substrate below the optical waveguide layer and an upper cladding layer on the patterned waveguide layer in the process of Chandross et al. (i.e., to sandwich the core layer between two cladding layers), as taught by Zha, with the reasonable expectation of successfully and advantageously producing a waveguide that has a guided mode desired by the purveyor in the art. Additionally, by sandwiching the core layer of Chandross et al. between two cladding layers, as is typically done in the art of planar optical waveguides (see Zha), one of ordinary skill in the art would have reasonably expected to reduce optical losses in the waveguide of Chandross et al. (i.e.,

because the lower refractive index cladding layers would serve to contain the light within the core of the waveguide and prevent the light from escaping from the core). Further and importantly, Zha teaches that hybrid inorganic-organic materials are excellent candidates for optical waveguide materials because the hybrid materials share many of the benefits of polymers (e.g., rapid material deposition, low processing temperature, etc.) while the silicate (i.e., inorganic) backbone increases the hardness and dilutes the hydrocarbon content, thereby reducing optical absorption (paragraph [0002]). In other words, Zha teaches that hybrid inorganic-organic materials combine the advantages of purely organic materials with the advantages of purely inorganic materials. Therefore, it would have been obvious to one of ordinary skill in the art to utilize a hybrid inorganic-organic material, such as the material taught by Zha, as the matrix material in the process of Chandross et al. with the reasonable expectation of successfully producing a waveguide by photolocking (as desired by Chandross et al.), the waveguide core being made of a material (i.e., a hybrid inorganic-organic material) that combines the advantages of an inorganic material (i.e., hardness, low optical loss) with the advantages of an organic / polymeric material (i.e., rapid material deposition, low processing temperature), thereby being superior to the solely polymeric waveguide material taught by Chandross et al. Regarding **Claim 2**, the combination of Chandross et al. and Zha also teaches that the hybrid matrix contains silicon and oxygen atoms (paragraphs [0019] – [0021], [0050], and [0055] of Zha) but does not explicitly teach that at least a fraction of the silicon is directly bonded to substituted or unsubstituted

hydrocarbon groups / moieties. However, the entire inorganic-organic hybrid matrix of Zha is based on polymerizing / bonding organically (e.g., hydrocarbon) modified alkoxides based on metals such as silicon, the silicon alkoxides having at least one M-C bond (i.e., Si-alkyl group bond) (paragraphs [0015] – [0020]). Therefore, it is the examiner's position that at least a fraction of the silicon atoms (i.e., from the silicon alkoxide) in the hybrid matrix of Zha et al. would have inherently been directly bonded to substituted or unsubstituted hydrocarbon groups / moieties such as alkyl groups. Regarding **Claim 3**, the combination of Chandross et al. and Zha also teaches that the hybrid matrix comprises an oxide of a metal selected from the elements of groups 3A, 4A, and 3B-5B of the periodic table, and combinations thereof (paragraphs [0021] and [0077] of Zha). Regarding **Claims 5 – 7**, the combination of Chandross et al. and Zha also teaches that the photochemical monomers are capable of being dimerized upon radiation, chemically bonding to chains constituting the matrix upon radiation, and/or being polymerized in the matrix upon radiation (Col.3, lines 39 – 55, Col.4, lines 42 – 65 of Chandross et al.). Regarding **Claim 8**, the combination of Chandross et al. and Zha also teaches that the monomers are selected from the group of monomers claimed by the applicant (Col.6, lines 36 – 37, Col.8, lines 52 and 61 of Chandross et al.). Regarding **Claims 9 and 10**, the combination of Chandross et al. and Zha teaches that the waveguide is formed by exposure to a beam through a mask covering the waveguide layer (Col.5, lines 28 – 35 of Chandross et al.) or exposure to a laser without a mask (Figure 2C; Col.5, lines 6 – 17, and Col.6, lines 52 – 58 of Chandross et al.).

15. Claims 2 – 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chandross et al. (USPN 3,809,732) in view of Zha (US 2003/0195321 A1), in further view of Dawes et al. (USPN 6,144,795).
16. The combination of Chandross et al. and Zha teaches all the limitations of **Claim 4** as set forth above in paragraph 14, except for a method wherein the hybrid matrix comprises fluorine atoms. However, it is clear that the hybrid matrix of Zha is open to including various dopant species (paragraph [0077], for example). Dawes et al. teaches that, in the art of producing an inorganic-organic hybrid optical waveguide device (i.e., with a waveguide material analogous to that of Zha's), it is desirable to include fluorine atoms in the matrix in order to suppress an undesirable infrared absorption band (Col.1, line 32, Col.5, lines 27 – 28, and Col.8, lines 7 – 16). Therefore, it would have been obvious to one of ordinary skill in the art to include fluorine atoms in the inorganic-organic hybrid matrix material of the combination of Chandross et al. and Zha with the reasonable expectation of successfully and advantageously suppressing an undesirable infrared absorption band in the waveguide material, thereby reducing optical losses in the waveguide.
17. As an alternative to the reasoning presented above in paragraph 14, the combination of Chandross et al. and Zha teaches all the limitations of **Claims 2 – 4** except for a method wherein the hybrid matrix contains (1) silicon and oxygen atoms, with at least a fraction of the silicon being directly bonded to substituted or unsubstituted hydrocarbon atoms, (2) an oxide of a metal selected from the

elements of groups 3A, 4A, and 3B-5B of the periodic table, and combinations thereof, and (3) fluorine atoms. Dawes et al. teaches an inorganic-organic hybrid material used to form the core of a planar optical waveguide, the material comprising (1) silicon and oxygen atoms, with at least a fraction of the silicon being directly bonded to substituted or unsubstituted hydrocarbon atoms, (2) an oxide of a metal selected from the elements of groups 3A, 4A, and 3B-5B of the periodic table, and combinations thereof, and (3) fluorine atoms (Abstract, Col.1, lines 17 – 41, Col.2, lines 40 – 67, Col.4, lines 40 – 67, Cols. 5 – 6, Col.7, lines 52 – 67, Col.8, lines 1 – 16, and Col.10, lines 51 – 57). This hybrid material taught by Dawes et al. has the following advantages: (1) low cost, (2) low absorbance, (3) can have a range of indices of refraction, (4) rapid deposition, and (5) unique visco-elastic properties that enable the material to avoid stress build-up during polymerization / curing (Col.2, lines 29 – 33, Col.11, lines 38 – 43). Therefore, it would have been obvious to one of ordinary skill in the art to utilize the inorganic-organic hybrid material of Dawes et al. as the waveguide material in the process of the combination of Chandross et al. and Zha with the reasonable expectation of successfully and advantageously utilizing a material for the waveguide core that is low cost, has low absorbance, can be rapidly deposited, and has unique visco-elastic properties that enable the material to avoid stress build-up during polymerization and curing.

***Response to Arguments***

18. Applicant's arguments filed on 1/5/2005 have been fully considered but they are not persuasive.
19. Regarding the 35 U.S.C. 103 rejections based on the combination of Kuramoto et al. and Chandross et al., the applicant argues that Kuramoto et al. merely suggests the shape of a simple core portion, and does not teach that this structure can be formed by photo-locking; accordingly the examiner's assertion that Kuramoto et al. discloses a core portion thicker than the surrounding area (the same as is disclosed in Chandross et al.) is not reasonable. In response, this argument is not convincing. Specifically, Kuramoto et al. explicitly teaches patterning the optical waveguide layer "15" to form a core portion "15a" that is thicker than the surrounding material of layer "15" (Figures 3 and 4; paragraphs [0142] – [0143]). The photo-locking process of Chandross et al. produces a waveguide having a thicker guiding (i.e., core) region surrounded by thinner regions of material (Figure 2D; Col.1, lines 26 – 28, Col.2, lines 42 – 63, and Col.5, lines 41 – 53). As such, the examiner's position that both Kuramoto et al. and Chandross et al. teach waveguide structures with a core portion thicker than the surrounding area is reasonable and supported by the art of record.
20. Second, the applicant argues that the purpose of Kuramoto et al. is not to provide a thicker core portion, but rather to provide a position limitation of the top surface of the core in a structure wherein a groove is formed on the substrate as a lower cladding layer and a core is formed within the groove. To support this argument, the applicant cites Figure 12 and claim 1 of Kuramoto et al. In response, this argument



is not convincing. Specifically, the examiner agrees with the applicant that one embodiment taught by Kuramoto et al. is a waveguide having a core formed within a groove, as evidenced by Figure 12 (noted by the applicant). However, this is only one embodiment out of a number of embodiments taught by Kuramoto et al. Another embodiment taught by Kuramoto et al. is a waveguide with a core portion thicker than the surrounding area (Figures 3 and 4; paragraphs [0061], [0062], [0142] – [0143]). Please note that a reference may be relied upon for all that it fairly teaches to one of ordinary skill in the art. The teachings of a reference are not limited to a single embodiment.

21. Third, the applicant argues that, although a technique of applying the photo-locking mechanism to a general organic polymer as a matrix has been publicly known, extending the application of such mechanism to an organic-inorganic hybrid material as a matrix, which is completely different in physical properties or chemical features from an organic polymer, is unreasonable. Other mechanisms (e.g., densification, condensation, migration, etc.) are present when dealing with an organic-inorganic hybrid material that cannot be expected when using an organic polymer alone. In response, this argument is not convincing. To begin, the examiner notes that obviousness does not require absolute predictability – only a reasonable expectation of success is required. In this case, the inorganic-organic hybrid matrix waveguide layer of Kuramoto et al. comprises a polymeric component such as polymethylmethacrylate (PMMA) (paragraphs [0019] and [0021]). Chandross et al. teaches manufacturing an optical waveguide device by using a “photolocking”

technique (Col.2, lines 35 – 40) in which a waveguide material based on a polymer such as PMMA (i.e., a polymer as taught by Kuramoto et al. to be a component of the waveguide layer) is uniformly doped with photosensitive photochemical monomers, deposited on a substrate, dried by evaporating the solvent, selectively exposed to a beam having a predetermined wavelength in order to photolock the monomers into the waveguide material layer, and heated to remove the unexposed monomers (Figures 1 and 2A – 2D; Col.1, lines 14 – 29, Col.2, lines 30 – 71, and Cols.3 – 6). Based on these teachings, one of ordinary skill in the art would have had a reasonable expectation of success when using the photo-locking technique of Chandross et al. with the inorganic-organic hybrid matrix of Kuramoto et al. because the photo-locking of the monomers would be expected to occur due to the interaction of the monomers with the organic (PMMA) component of the hybrid matrix, regardless of whether other, inorganic components are present in the matrix as well. In other words, since a PMMA matrix supports a photo-locking technique, it is reasonable to infer that PMMA in combination with other inorganic components will also support a photo-locking technique. The applicant has not provided any objective evidence to contradict the “reasonable expectation of success” set forth by the examiner.

22. Fourth, the applicant argues that Kuramoto et al. expresses reservations about using a photopolymerization initiator when using the organic-inorganic hybrid material as a core due to degraded optical transmittance (paragraph [0040]), and as such, one of ordinary skill in the art would not have added such an initiator when a hybrid material

is used as a waveguide core. In response, this argument is not convincing. While Kuramoto et al. does teach that a photopolymerization initiator is not preferred in an organic-inorganic hybrid material waveguide core (paragraph [0040]), this teaching does not suggest that such an initiator cannot be added to the hybrid core material – it is simply not preferred by Kuramoto et al. Additionally, this teaching of Kuramoto et al. must be weighed against the teachings of the prior art in general, which clearly indicate that a photoinitiator can be and is successfully used in a hybrid organic-inorganic waveguide core material (see, for example, Zha (US 2003/0195321 A), previously cited by the examiner, which teaches including a photoinitiator in a hybrid organic-inorganic matrix waveguide core material (paragraphs [0001] and [0074]), the resulting material having a low optical absorbance (paragraphs [0002] and [0057])). To further support the examiner's position, please see Hitachi (JP 2001-281475 A), which also teaches including a photosensitizer in a hybrid organic-inorganic matrix waveguide core material.

23. Fifth, the applicant argues that there is no motivation to combine Kuramoto et al. and Chandross et al. in the manner proposed by the examiner. In response, this argument is not convincing. The photolocking process taught by Kuramoto et al. has the following advantages: (1) smooth refractive index and thickness profiles, (2) minimized scattering losses, (3) high spatial resolution, and (4) relative simplicity and economy (Col.2, lines 63 – 71). Therefore, one of ordinary skill in the art would have been motivated to form the patterned inorganic-organic hybrid matrix waveguide layer of Kuramoto et al. by photolocking in order to reap the benefits of using

photolocking to form a waveguide layer, such as producing a waveguide layer having thicker core portions surrounded by thinner portions of material, the waveguide having a smooth refractive index and thickness profile, minimal scattering losses, a high spatial resolution, and a relatively simple and economic method of production.

24. Regarding the 35 U.S.C. 103 rejections based on the combination of Chandross et al. and Zha, the applicant argues that one of ordinary skill in the art would not have considered the application of photo-locking to be feasible with a core material formed of an organic-inorganic hybrid material. To support this argument, the applicant again cites the “negative” teaching in the Kuramoto et al. reference. In response, the “negative” teaching of Kuramoto et al. must be weighed against the teachings of the prior art in general, which clearly indicate that a photoinitiator can be and is successfully used in a hybrid organic-inorganic waveguide core material (see, for example, Zha (US 2003/0195321 A), previously cited by the examiner, which teaches including a photoinitiator in a hybrid organic-inorganic matrix waveguide core material (paragraphs [0001] and [0074]), the resulting material having a low optical absorbance (paragraphs [0002] and [0057]); and Fardad et al. (USPN 6,054,253), previously cited in the applicant’s specification, which teaches including a photoinitiator (Col.5, lines 9 – 15) in an inorganic-organic sol-gel material used to produce a waveguide core). To further support the examiner’s position, please see Hitachi (JP 2001-281475 A), which also teaches including a photosensitizer in a hybrid organic-inorganic matrix waveguide core material.

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25. To conclude, the examiner notes that independent Claim 1 requires, in part, that the inorganic-organic hybrid matrix is selectively exposed to a beam, "unexposed monomers are removed", and the patterned layer is cured by thermal heating. In examination of the instant application, the examiner has interpreted the "unexposed monomers are removed" step to exclude processes in which the entire unexposed layer is removed (i.e., by etching). This interpretation is consistent with the applicant's disclosure (see page 3 of the originally filed specification). If the applicant intends for such etching processes to be included in the scope of the claims by the "unexposed monomers are removed" recitation, it appears that the Fardad et al. reference (USPN 6,054,253) cited on page 3 of the applicant's specification would form the basis of a rejection under 102/103.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Chen et al. (USPN 6,852,358) teaches making an organic-inorganic hybrid material waveguide by photolithography.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

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shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (571) 272-1422. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tim Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

WDM

WDM

Wesley D Markham  
Examiner  
Art Unit 1762

TIMOTHY MEEKS  
PRIMARY EXAMINER